Amendment to description

DISCLOSURE OF THE INVENTION

An object of the present invention is to provide a compact-size disk drive, disk feeding device, and disk loading mechanism that make it possible to effectively utilize space within a disk drive and permit a straightforward layout of members.

In order to achieve the above object, the present invention possesses the following technological characteristics in a disk drive comprising a disk holder that has a plurality of disk holding members that individually hold a plurality of disks, a drive unit that plays back a desired disk, and drive movement means for moving the drive unit into a space that is formed by the rise and fall of the disk holding members, wherein the opening amount of the disk holder by the rise and fall of the disk holding member is fixed.

That is, the present invention comprises a disk insertion/ejection portion that inserts and ejects a disk to and from the disk holder, wherein the disk insertion/ejection portion comprises a loading roller and a drive portion that causes the loading roller to turn; the drive portion is provided at either of the two ends of the loading roller; and the center of the disk in the disk storage portion approaches the side where the drive portion is provided.

In the present invention above, because part of the disk storage portion is provided in the space within the drive portion,

space can be effectively utilized.

In a preferred embodiment, the opening amount of the disk holder by the rise and fall of the disk holding member is fixed; and the height of insertion into the disk holder is on the upper side between the highest disk holding member and the lowest disk holding member when the disk holder is open.

In such an aspect, it is possible to effectively use space within the drive without the required space above and below the disk holder being different depending on which disk is played back because the opening amount of the disk holder is fixed.

Furthermore, the disk insertion height is at the top within a fixed opening amount of the disk holder and, therefore, the disk slot provided in the front panel of the disk drive can be provided at the top thereof. For this reason, a large space for providing the display portion or operating portion can be taken in comparison with a case where the disk slot is provided at the height of the center of the front panel. On the other hand, because the opening amount of the disk holder is fixed, the required space does not increase in an upward direction.

In a preferred embodiment, a disk selector that holds a disk holding member holding a desired disk at the disk insertion height when a disk is inserted into the disk holder, and retracts the disk holding member holding the desired disk below the disk during disk playback is provided.

In such an aspect, the disk holding member that is held

by the disk selector during disk insertion is retracted downward during disk playback and therefore the disk insertion position can be at the top and an upward increase in required space can be suppressed.

In a preferred embodiment, the drive unit and the disk selector are provided in a drive chassis unit; and the drive chassis unit is provided so as to be capable of rising and falling with respect to the disk holder.

In such an aspect, the drive unit and disk selector are able to rise or fall while retaining a fixed distance from each other as result of the rise or fall of the drive chassis unit. Therefore, the distance between the division position of the disk holder and the disk playback position is always fixed and a stable operation is permitted.

In a preferred embodiment, the drive chassis unit is provided with disk insertion/ejection means that inserts and ejects the disk into and from the disk holder.

In such an aspect, the drive unit, disk selector and disk insertion/ejection means is able to rise and fall while retaining a fixed distance from each other by the rise or fall of the drive chassis unit. Therefore, the distance between the disk insertion position, division position of the disk holder and disk playback position is always fixed and a stable operation is permitted.

In a preferred embodiment, disk grasping means for grasping the desired disk when the disk holding member is caused to rise

and fall by the disk selector is provided.

In such an aspect, in a state where the disk itself is grasped by the disk grasping means, the desired disk can be placed by completely retracting the disk holding members above and below the desired disk by means of the disk selector and then moving the drive unit into the space. Therefore, in order to transfer the disk from the disk holding members to the drive unit, a complex operation is not required of a specified disk holding member and the disk selector can be simplified.

A preferred embodiment is a disk feeding device comprising a disk storage portion that stores disks and a disk insertion/ejection portion that inserts and ejects disks to and from the disk storage portion, wherein a disk guide that guides the movement of the disk between the disk insertion/ejection portion and the disk storage portion is provided; the disk insertion/ejection portion comprises a loading roller and a drive portion that causes the loading roller to turn; the drive portion is provided at either of the two ends of the loading roller; and the center of the disk in the disk storage portion approaches the side where the drive portion is provided.

In such an aspect, the disk can be reliably moved between the disk insertion/ejection portion and disk storage portion by the disk guide, whereby an effective application of the required space by arranging the disk insertion/ejection portion and disk storage portion with displacement is permitted.

Further, because part of the disk storage portion is provided in the space within the back of the drive portion, space can be effectively utilized.

In a preferred embodiment, the disk guide comprises an oblique face that changes the direction of movement of the disk by contacting the outer edge of the disk.

In such an aspect, because the movement of the disk can be guided by a plain and simple member, the disk drive does not increase in size.

A preferred embodiment is a disk drive comprising the disk feeding device, wherein the disk storage portion is a disk holder provided so as to be capable of storing a plurality of disks and of being divided, the disk drive comprises a drive unit that is provided so as to be capable of moving between the divided disk holders and which plays back a desired disk, and the drive unit is provided on the opposite side from the side approached by the center of the disk in the disk holder, in the vicinity of the disk holder.

In such an aspect, because the drive unit is provided in a space that is produced as a result of the disk holder being arranged to approach the drive portion, space can be effectively utilized and overall miniaturization of the disk drive is possible. Further, the drive unit is provided on the opposite side from the drive portion and, therefore, interference and collisions between the drive unit and drive portion can be prevented.

In a preferred embodiment, the drive unit comprises: a turntable on which a disk is mounted; and a disk clamping mechanism that sandwiches the disk between the disk clamping mechanism and the turntable during disk playback and allows the disk to pass to and from the turntable during disk insertion and ejection.

In such an aspect, by using a disk clamping mechanism that sandwiches the disk between the disk clamping mechanism and a turntable during playback, resistance to vibration is possible and, because the disk can be passed between the turntable and disk clamping mechanism during disk insertion/ejection, the drive unit can be provided in a position close to the disk insertion/ejection portion and disk holder, miniaturization of the drive is possible.

In a preferred embodiment, a pair of disk selectors for dividing the disk holder are provided on one pair of side portions of the disk holder that are orthogonal to each other; and the drive unit and the disk insertion/ejection portion are provided respectively on the other pair of side portions of the disk holder that are orthogonal to each other.

In such an aspect, the disk selector for which the required space is relatively small, and the drive unit or disk insertion/ejection portion for which the required space is relatively large are provided in opposing positions with the disk holder interposed therebetween, whereby one of the depth direction and width direction of the disk drive does not increase and overall

compactness can be established.

A preferred embodiment is a disk loading mechanism comprising a disk insertion/ejection portion that inserts and ejects a disk into and from a disk drive that is capable of storing disks thereinside, wherein the disk insertion/ejection portion is provided so as to be capable of moving in the direction of contact with and separation from a disk in the disk drive; the drive portion that drives the disk insertion/ejection portion is fixed to the disk drive; and the disk insertion/ejection portion is provided so as to be capable of connecting to and disconnecting from the drive portion in accordance with the movement of the disk insertion/ejection portion.

In such an aspect, the disk insertion/ejection portion moves in the direction of contact with and separation from the disk and, therefore, a member or mechanism for pushing the disk in or out need not be provided on the side for storing the disk. Hence, a smaller footprint is implemented and overall miniaturization of the disk drive is possible.

Further, because the drive portion is fixed and only the disk insertion portion moves, the moving parts are at the required minimum, the space secured for movement is reduced, and miniaturization of the disk drive can be implemented.

In a preferred embodiment, the disk insertion/ejection portion is a loading roller; the loading roller is provided with a roller gear; the drive portion comprises a motor and a gear

mechanism that is operated by the motor; and the gear mechanism is provided so as to be capable of engaging with and disengaging from the roller gear in accordance with the movement of the loading roller.

In such an aspect, because the disk insertion/ejection portion is a loading roller, the contact length with respect to the disk surface is long. As a result, movement and alignment for contact with and separation from the disk can be performed easily by means of a simple operation.

In addition, the connection and disconnection of the disk insertion/ejection portion and drive portion can be performed by means of a simple method such as engagement and disengagement of a gear mechanism and roller gear, whereby simplification of the structure and the securing of a reliable operation can be implemented.

A preferred embodiment is a disk drive comprising a disk holder that stores disks thereinside and a drive unit for playing back a desired disk, comprising the disk loading mechanism.

In such an aspect, the disk holder does not require a member or mechanism for pushing the disk in or out. Therefore, miniaturization of the disk holder and disk drive is possible.

In a preferred embodiment, the disk holder has a plurality of disk holding members that individually hold a plurality of disks, the disk drive comprising: a disk selector that forms a space above and below a desired disk by causing the disk holding

members to rise and fall; and drive moving means that causes the drive unit to move into the space formed by the rise and fall of the disk holding members, disk insertion/ejection portion moving means which, when a space is formed above and below the desired disk by the disk selector, allows the disk insertion/ejection portion to move in the direction of contact with the desired disk and which, when the desired disk is played back by the drive unit, allows the disk insertion/ejection portion to move in a direction away from the desired disk.

In such an aspect, when a space is formed above and below the desired disk in order to insert the drive unit, the disk can be grasped by the disk insertion/ejection portion, whereby retraction of the disk holding member in order to play back the desired disk can be performed smoothly.

A preferred embodiment is a disk feeding device comprising a disk storage portion that stores disks and a disk insertion/ejection portion that inserts and ejects disks to and from the disk storage portion, wherein the disk insertion/ejection portion comprises a loading roller and a drive portion that causes the loading roller to turn; the drive portion is provided at either of the two ends of the loading roller; and the center of the disk in the disk storage portion approaches the side where the drive portion is provided.

In such an aspect, because part of the disk storage portion is provided in the space within the drive portion, space can be

effectively utilized.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is an exploded perspective view of an embodiment of the disk drive of the present invention;

Fig. 2 is a transparent planar view during disk loading of the embodiment in Fig. 1;

Fig. 3 is a transparent planar view of a state where the disk is stored in the disk holder of the embodiment in Fig. 1;

Fig. 4 is a front view of the embodiment in Fig. 1;

Fig. 5 is an exploded perspective view of the disk holder of the embodiment in Fig. 1;

Fig. 6 is a planar view of a holder plate and disk holding mechanism of the disk holder in Fig. 5;

Fig. 7 is a planar view of the holder plate and disk holding mechanism of the lowest layer of the disk holder in Fig. 5;

Fig. 8 is a planar view of the holder plate in Fig. 6;

CLAIMS

1. (Amended) A disk drive comprising a disk holder that has a plurality of disk holding members that individually hold a plurality of disks, a drive unit that plays back a desired disk, and drive movement means for moving the drive unit into a space that is formed by the rise and fall of the disk holding members, comprising:

a disk insertion/ejection portion that inserts and ejects a disk to and from the disk holder,

wherein the disk insertion/ejection portion comprises a loading roller and a drive portion that causes the loading roller to turn;

the drive portion is provided at either of the two ends of the loading roller; and

the center of the disk in the disk holder approaches the side where the drive portion is provided.

2. (Amended) The disk drive according to claim 1, wherein the opening amount of the disk holder by the rise and fall of the disk holding member is fixed; and

the height of disk insertion into the disk holder is on the upper side between the highest disk holding member and the lowest disk holding member when the disk holder is open.

3. The disk drive according to claim 2, wherein a disk

selector that holds a disk holding member holding a desired disk at the disk insertion height when a disk is inserted into the disk holder, and retracts the disk holding member holding the desired disk below the disk during disk playback is provided.

4. The disk drive according to claim 3, wherein the drive unit and the disk selector are provided in a drive chassis unit; and the drive chassis unit is provided so as to be capable of rising and falling with respect to the disk holder.

5. The disk drive according to claim 4, wherein the drive chassis unit is provided with disk insertion/ejection means that inserts and ejects the disk into and from the disk holder.

6. The disk drive according to any one of claims 3 to 5, wherein disk grasping means for grasping the desired disk when the disk holding member is caused to rise and fall by the disk selector is provided.

7. (Amended) A disk feeding device comprising a disk storage portion that stores disks and a disk insertion/ejection portion that inserts and ejects disks to and from the disk storage portion,

wherein a disk guide that guides the movement of the disk between the disk insertion/ejection portion and the disk storage portion is provided;

the disk insertion/ejection portion comprises a loading roller and a drive portion that causes the loading roller to turn;

the drive portion is provided at either of the two ends of the loading roller; and

the center of the disk in the disk storage portion approaches the side where the drive portion is provided.

8. (Deleted)

9. (Amended) The disk feeding device according to claim 7, wherein the disk guide comprises an oblique face that changes the direction of movement of the disk by contacting the outer edge of the disk.

10. (Amended) A disk drive comprising the disk feeding device according to claim 7 or 9,

wherein the disk storage portion is a disk holder provided so as to be capable of storing a plurality of disks and of being divided,

the disk drive comprises a drive unit that is provided so as to be capable of moving between the divided disk holders and which plays back a desired disk, and

the drive unit is provided on the opposite side from the side approached by the center of the disk in the disk holder,

in the vicinity of the disk holder.

11. The disk drive according to claim 10, wherein the drive unit comprises:

a turntable on which a disk is mounted; and

a disk clamping mechanism that sandwiches the disk between the disk clamping mechanism and the turntable during disk playback and allows the disk to pass to and from the turntable during disk insertion and ejection.

12. The disk drive according to claim 10 or 11, wherein a pair of disk selectors for dividing the disk holder are provided on one pair of side portions of the disk holder that are orthogonal to each other; and

the drive unit and the disk insertion/ejection portion are provided respectively on the other pair of side portions of the disk holder that are orthogonal to each other.

13. (Amended) A disk loading mechanism comprising a disk insertion/ejection portion that inserts and ejects a disk into and from a disk drive that is capable of storing disks thereinside,

wherein the disk insertion/ejection portion is provided so as to be capable of moving in the direction of contact with and separation from a disk in the disk drive;

the drive portion that drives the disk

insertion/ejection portion is fixed to the disk drive; and

the disk insertion/ejection portion is provided so as to be capable of connecting to and disconnecting from the drive portion in accordance with the movement of the disk insertion/ejection portion.

14. (Deleted)

15. (Deleted)

16. (Amended) The disk loading mechanism according to claim 13, wherein the disk insertion/ejection portion comprises a loading roller;

the loading roller is provided with a roller gear;

the drive portion comprises a motor and a gear mechanism that is operated by the motor; and

the gear mechanism is provided so as to be capable of engaging with and disengaging from the roller gear in accordance with the movement of the loading roller.

17. (Amended) A disk drive comprising a disk holder that stores disks thereinside and a drive unit for playing back a desired disk, comprising:

the disk loading mechanism according to claim 13 or 16.

18. The disk drive according to claim 17, wherein the disk holder has a plurality of disk holding members that individually hold a plurality of disks, the disk drive comprising:

a disk selector that forms a space above and below a desired disk by causing the disk holding members to rise and fall;

drive moving means that causes the drive unit to move into the space formed by the rise and fall of the disk holding members; and

disk insertion/ejection portion moving means which, when a space is formed above and below the desired disk by the disk selector, allows the disk insertion/ejection portion to move in the direction of contact with the desired disk and which, when the desired disk is played back by the drive unit, allows the disk insertion/ejection portion to move in a direction away from the desired disk.

19. (Added) A disk feeding device comprising a disk storage portion that stores disks and a disk insertion/ejection portion that inserts and ejects disks to and from the disk storage portion,

wherein the disk insertion/ejection portion comprises a loading roller and a drive portion that causes the loading roller to turn;

the drive portion is provided at either of the two ends of the loading roller; and

the center of the disk in the disk storage portion approaches the side where the drive portion is provided.